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(54) Abstract Title
Torsional vibration damper

(57) A torsional vibration damper has a pre-damper 3 acting across a toothing with circumferential play between a hub 11 and a main damper flange 8. The pre-damper comprises an input member 29 with projections 30 push fitting into recesses 31 in the flange, an output flange 32 mounted between one axial side of the main damper flange and a main damper friction lining support disc 4 and springs 33 arranged for two stage damping arranged in windows 34, 35, 36. A conical friction device 44 lies on a hub shoulder 45 connected by plate spring 46 to a friction control disc 47 which has axial extensions 50 engaging the springs through main flange windows. The extensions interact with the second stage pre-damper springs. The second stage springs may have the same or greater stiffness as those of the first stage.

Fig.1

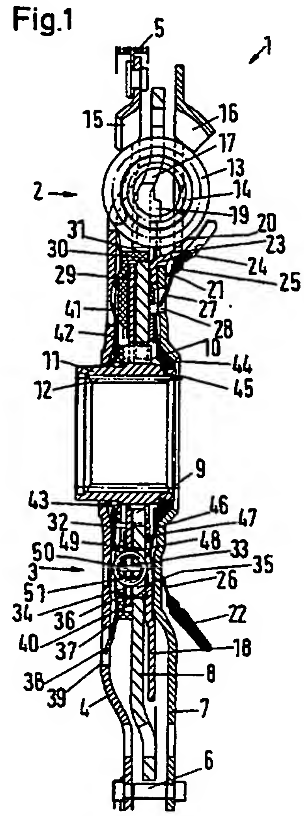

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Fig.1

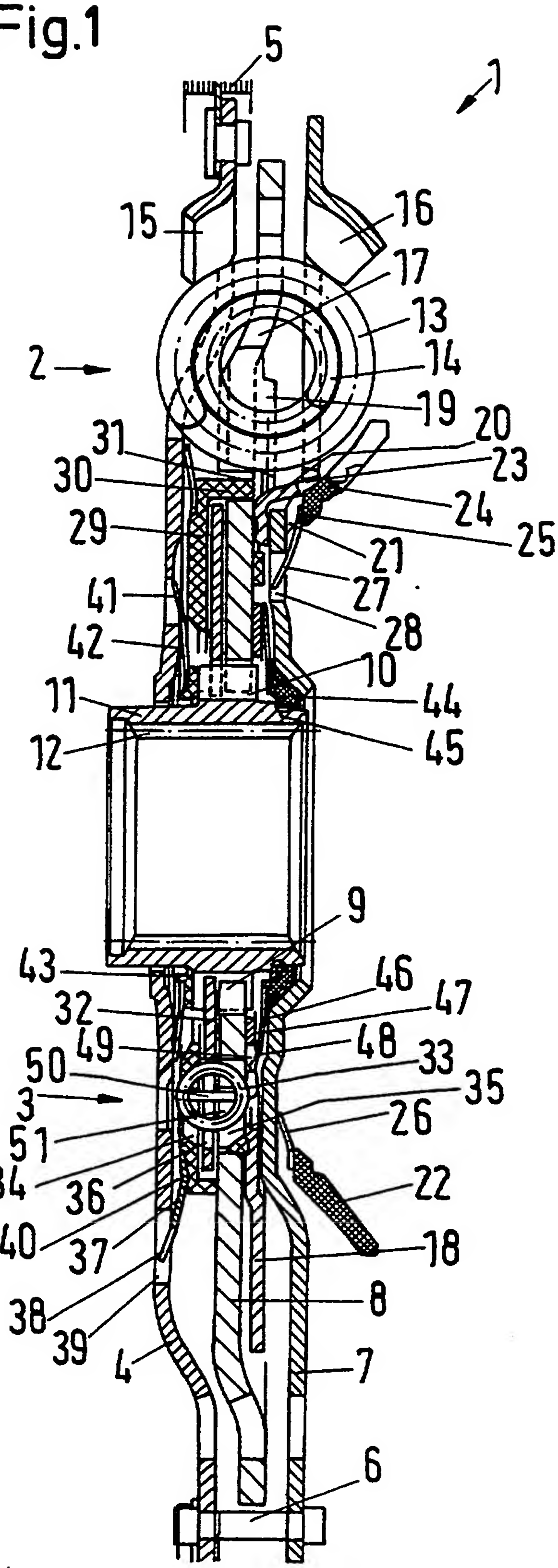
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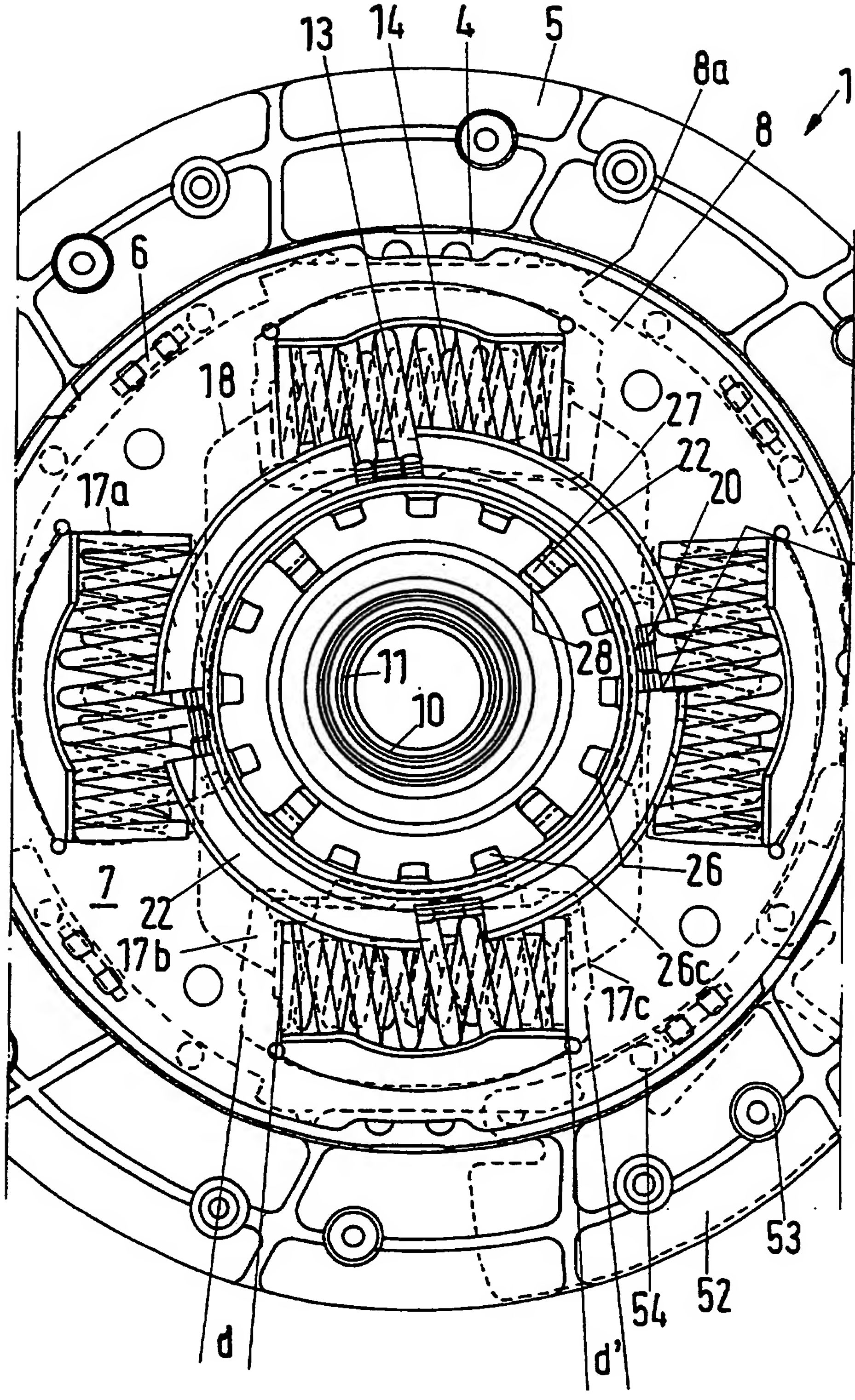
Fig. 2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27
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8b
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26c
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52
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Torsion vibration damper

The invention relates to a torsion vibration damper more particularly for motor vehicle clutches with relatively rotatable input and output parts between which there is at least one damping device having energy accumulators.

For these torsion vibration dampers numerous friction devices have been proposed where there is friction engagement between the input and output part or the component parts associated with same.

The object of the present invention is to provide a torsion vibration damper of the kind already mentioned which has a satisfactory function, increased service life as well as a simple compact construction. Furthermore easy assembly and cost-effective manufacture are also to be ensured.

According to the invention there is provided a torsion vibration damper with at least one preliminary damper acting over an angular region and having energy accumulators of lesser stiffness, and at least one main damper acting over a further angular region and having energy accumulators of a greater stiffness, wherein the energy accumulators are compressible between the relevant associated input and output parts of the preliminary and main damper, wherein the output part of the torsion vibration damper is a hub which holds a flange which has an internal profile and forms the output part of the main damper, with this internal profile engaging with torsional play with an external profile of the hub, furthermore on each side of the flange there is a side disc and these side discs are connected together secured against rotation

and form the input part of the main damper, characterised in that an input part, which is rotationally connected to the flange, and an output part, which is rotationally connected to the hub, of the preliminary damper are mounted axially between one of the side discs and the flange, furthermore a friction control disc is provided axially between the other side disc and the other side of the flange, wherein the friction control disc has extension arms which engage with torsional play in recesses of the flange and interact with energy accumulators of the preliminary damper which only become active after a relative rotation between the input part and output part of the preliminary damper from an initial starting position.

To control the friction the friction control disc is advantageously attached by the energy accumulators mounted in the rotational direction between the input and output part, and for this purpose contact bearing faces are provided on the friction control disc for the energy accumulators - preferably coil springs - which are arranged for example between the spring ends of the energy accumulators on the circumferential side and the biasing areas of the input or output parts. Furthermore the friction control disc can engage with axially aligned extension arms through the recesses in the disc-like component part with rotational play and form a rotationally secured connection with the annular component part. The formation of the friction engagement can be directly between the friction control disc and the disc-like component part and/or the annular component part with the disc-like component part. Furthermore at least one axially active energy accumulator, such as in particular a plate spring, can be tensioned between the disc-like

component part and the annular component part or the friction control disc and thus the friction engagement can be set in the area between the plate spring and annular component part or friction control disc wherein the plate spring in this case is attached rotationally secured on the disc-like component part. If the rotationally secured connection of the spring is selected with the annular component part or with the friction control disc then the friction engagement is set on the disc-like component part.

An axial self-locking device, such as for example a snap fitting closure, bayonet lock or the like can be provided between the extension arms and the component part connected therewith - namely the friction control disc or annular component part. The friction control disc can advantageously have the axially aligned extension arms which engage through the disc-like component part and form the snap-fitting closure with the annular component part. One of the two component parts can be made of plastics and the second component part, for example the friction control disc, can be made of metal so that the snap fit connection exists through the different elasticities of the component parts. Advantageously recesses can be provided in the plastics part into which the extension arms engage whereby snap-fitting noses can be provided in the recesses to form the snap-fitting connections with the complementary recesses in the extension arms. The annular component part is advantageously formed frusto-conical and can where necessary have contact bearing faces for the axially acting plate spring, for example in the area of the inner circumference on a friction face provided for same and formed axially to face the disc-like component part.

The torsion vibration damper according to the idea according to the invention can advantageously be designed so that the input part is formed by a friction lining support disc and a counter disc wherein the two component parts can be axially connected together by bolts and a disc-like flange part can be mounted axially between same as output part. Energy accumulators acting at least in the circumferential direction are provided in the force flow between the output and input part whereby the input part and output part can rotate relative to each other against the force of same. The friction control disc can thereby be mounted axially between the flange part and one of the disc parts on the input side.

A further advantageous development of a torsion vibration damper proposes the formation of a preliminary damper having energy accumulators of lesser stiffness and a main damper having energy accumulators of greater stiffness wherein the output parts of the preliminary damper and of the main damper engage by means of an internal profiled section into an outer profiled section of a hub part and can form a rotationally locked connection wherein the hub part is connected rotationally locked with internal gearing to a gear input shaft. A rotational play is preferably provided between the output part of the main damper and the hub part so that the main damper is switched off during the turning area in which the preliminary damper is active.

Furthermore it can be advantageous to design the preliminary damper and/or main damper in two stages, i.e. to allow one part of the energy accumulators to be active immediately and a second part of the energy accumulators

to be active only from larger turning angles whereby the friction control disc can be activated with the first stage, thus over the entire turning area of the main damper or only in the second stage whereby an additional hysteresis stage can be achieved as a result of the friction engagement which is then set.

When using a preliminary damper it can be advantageous to house the preliminary damper on one side and the friction control disc on the other side of the flange on the output side and/or to house the two component parts radially inside the energy accumulators of the main damper, whereby axial structural space is gained accordingly.

The friction control disc which engages in the preliminary damper can have axial socket areas for the energy accumulators of the preliminary damper or follower devices for same in the circumferential direction and are in direct friction engagement with a component part on the output or input side. An axially operating energy accumulator such as a plate spring can be provided between these two component parts and can be connected rotationally secured to the friction control disc and can be in friction engagement with the input part of the torsion vibration damper or a component part connected rotationally secured to same, wherein this component part can be a friction disc which is advantageously fixed on the outer circumference of the hub part. It can also be advantageous in many cases to attach the plate spring rotationally secured on the input part of the torsion vibration damper and to bring the plate spring into friction engagement with the friction control disc of the preliminary damper.

The invention will now be explained in further detail with reference to the following drawings in which:

Figure 1 is a sectional view of part of a clutch disc; and

Figure 2 is a partial view of the same clutch disc.

Figure 1 shows an embodiment of a torsion vibration damper or clutch disc 1 having a main damper 2 and a preliminary damper 3. The input part of the clutch disc 1 which at the same time represents the input part of the main damper 2 is formed by a follower disc 4 supporting friction linings 5 as well as by a counter disc 7 connected rotationally secured to the follower disc by spacer bolts 6 which can be of rectangular section with a longer side lying in a circumferential direction. The output part of the main damper 2 is formed by a flange 8 which has internal teeth 9 which engage in external teeth 10 of a hub part 11 which forms the output part of the clutch disc 1. Between the external teeth 10 of the hub part 11 and the internal teeth 9 of the flange 8 there is a tooth flank clearance in the circumferential direction which corresponds to the active area of the preliminary damper 3. The hub part 11 furthermore has internal teeth 12 for fitting onto a gear input shaft. The maximum relative rotation between the input and output parts is fixed by the bolts 6 which are guided in recesses of the flange 8 (which are not shown in Figure 1 but are described with reference to Figure 2) and which act as stops.

The main damper 2 has interfitting springs 13, 14 which are provided in window-shaped recesses 15, 16 of the follower disc 4 and the counter disc 7. The shape of

these recesses prevents axial or radial escape of the springs 13, 14 which are also supported within window-shaped cut-out sections 17 of the flange 8. Relative rotation against the action of the springs 13,14 is possible between the flange 8 and the discs 4,7 (which are connected together rotationally secured).

A friction control disc 18 encloses the springs 13, 14 on both sides by contact bearing areas 19 and is mounted axially between the flange 8 and the counter disc 7. In the circumferential direction the disc 18 is mounted between the spring ends and the cut-out sections 17 (which form biasing areas) of the flange 8. The cut-out sections 17 in the case of one part of the springs 3, 14, (preferably those parts enclosed by the contact bearing faces 19 of the friction control disc 18) are larger in the circumferential direction than the extent of the springs 13, 14 in the circumferential direction so that on relative rotation between the input part and the output part, the springs 13, 14 are entrained by the cut-out sections and biasing areas 17 only when greater turning angles occur. In this way, a two-stage main damper 2 is formed. Both the first and second damper stages are subject to the additional friction produced by the friction control disc 18, but the first stage is always subject to the damping of the springs 13,14 whilst the second stage travels through the available play d or d' before becoming subject to the damping effect of the springs.

The friction control disc 18 has axial extension arms 20 which engage through recesses 21, with rotational play which is at least equal to the maximum turning angle of the second damper stage of the main damper 2 of the flange

8. The arms 20 form a rotationally secured and axially fixed connection with an annular friction ring 22. To this end recesses 23 are provided in the extension arms 20 into which snap-fitting noses 24 of the friction ring are engaged. In the area of the inner circumference of the friction ring 22 an axially formed friction surface 25 is provided which is in friction connection with a plate spring 26. The plate spring 26 has teeth 27 provided on the inner circumference which engage into corresponding recesses 28 to support and rotationally secure the spring on the counter disc 7 of the input part. The shape of the annular component part 22 is adapted radially outwards to the contour of the springs 13, 14 and counters their escape in an axial direction.

The preliminary damper 3 consists of a support part 29, which forms the input part and has axial projections 30 which push in to corresponding recesses 31 of the flange 8 A flange part 32 forms the output part and the damper also has energy accumulators (springs) 33. The support part 29 is located axially between the friction lining support disc 4 and the flange 8 and thus on the side of the flange 8 opposite the friction control disc 22 of the main damper 2. Window-shaped recesses 34, 35, 36 are provided in the support part 29, in the flange 8 and in the output part 32 to hold the energy accumulators 33 and serve at the same time as biasing devices for the energy accumulators 33. One part of the recesses 34, 35 or alternatively 36 can have an extent in the circumferential direction greater than the extent of the associated energy accumulators 33 so that the energy accumulators 33 set therein are biased later and a two-stage preliminary damper 3 can thereby be formed. Also springs 13, 14, 33 with a stiffer characteristic than in the first stage can also be used

for the second stage of the preliminary damper 3 and in the main damper 2 for the second stage.

The preliminary damper 3 is tensioned against the friction lining support 4 by means of a plate spring 37 which is supported rotationally secured by external teeth 38 in corresponding recesses 39 of the friction lining support 4 and is in friction engagement with a contact bearing face 40 of the support part 29. This arrangement thus represents basic friction for the entire turning angle of the preliminary torsion vibration damper. A further device for basic friction is likewise formed by a plate spring 42 rotationally secured on the follower disc 4 by means of external teeth 41 which engage in recesses in the disc 4, and which is in connection with a friction disc 43 adjacent the external teeth 10 of the hub part 11.

The friction device for the preliminary damper 3 is formed by a friction ring 44 which is mounted around the hub part 11 and is also the stop ring for the counter disc 7. For this purpose it has a conical form and is placed on a shoulder 45 of the hub 11. The friction device also comprises a plate spring 46 in friction connection with the friction ring 44, and a friction control disc 47. The plate spring 46 is rotationally secured by external teeth 48 in corresponding recesses 49 of the friction control disc 47. The friction control disc 47 also has, at its radially outer edge, axially aligned extension arms 50 which engage through recesses 51 (with rotational play at least equal to the maximum turning angle of the preliminary damper 3) in the flange 8 and form on both sides contact bearing faces for the energy accumulators 33. so that with a deflection of these the friction control disc 47 controls the friction engagement of the

plate spring 46 on the friction ring 44. An alternative attachment of the friction control disc 47 can be achieved where the extension arms 50 are supported in correspondingly formed recesses in the output part 32. The maximum turning angle of the preliminary damper 3 is fixed by the rotational play between the inner teeth 9 of the flange 8 and the external teeth 10 of the hub part 11.

Figure 2 shows in partial view an embodiment of a torsion vibration damper 1 with the follower disc (friction lining support) 4 supporting the profiled friction linings 5 with the friction linings 5 being riveted to the support plates 52 by means of rivets 53 fastened alternately from one side and the other. The linings are connected axially elastically to the lining support disc 4 by means of rivets 54. In this view the annular component part 22, the counter disc 7, the hub part 11 with internal teeth 10 as well as the energy accumulators 13,14 can all be clearly seen. Parts underneath are shown in dotted lines.

The annular component part 22 has recesses 22a with radially aligned noses 24 (only shown in Figure 1) for holding the extension arm 20 of the friction control disc 18 and for forming the snap-fitting closure. The plate spring 26 is tensioned by internal teeth 26a between the friction ring 22 and the counter disc and engages to secure the rotationally fixed contact with extended tongues 27 into the correspondingly recessed openings 28 in the counter disc 7.

The recesses 17a,17b,17c (Figure 1) provided in the flange 8 for controlling the energy accumulators 13, 14 are formed differently for forming a two-stage main damper 2. The recesses 17a directly contact the ends of the energy

accumulators 13, 14 and bias these immediately during relative rotation between the input and output parts of the main damper 2. The recesses 17b and 17c have adjacent the ends of the energy accumulators 13, 14 a rotational play d, d' whereby the springs are only biased after a turning angle corresponding to the distances d, d' and thus form the second main damper stage. Different distances d, d' define a different turning angle at which the second damper stage is activated for the coast and drive direction. However the distance d for the drive stage is preferably larger.

The maximum turning angle of the input part (ie the counter disc 7 connected axially by the flat bolts 6 to the friction lining support 4) relative to the flange 8 is defined by recesses 8a, 8b provided in the flange 8 against which the flat bolts 6 stop on reaching the maximum turning angle. The clutch disc 1 illustrated in Figure 2 shows the rest state and it can be seen that even with maximum turning angle in the direction of the drive stage a greater turning angle is permitted than in the coast stage.

The patent claims filed with the application are proposed wordings without prejudice for obtaining wider patent protection. The applicant retains the right to claim further features disclosed up until now only in the description and/or drawings.

References used in the sub-claims refer to further designs of the subject of the main claim through the features of each relevant sub-claim; they are not to be regarded as dispensing with obtaining an independent subject protection for the features of the sub-claims referred to.

The subjects of these sub-claims however also form independent inventions which have a design independent of the subjects of the preceding claims.

The invention is also not restricted to the embodiments of the description. Rather numerous amendments and modifications are possible within the scope of the invention, particularly those variations, elements and combinations and/or materials which are inventive for example through combination or modification of individual features or elements or process steps contained in the drawings and described in connection with the general description and embodiments and claims and which through combinable features lead to a new subject or to new process steps or sequence of process steps insofar as these refer to manufacturing, test and work processes.

CLAIMS

1. Torsion vibration damper with at least one preliminary damper acting over an angular region and having energy accumulators of lesser stiffness, and at least one main damper acting over a further angular region and having energy accumulators of a greater stiffness, wherein the energy accumulators are compressible between the relevant associated input and output parts of the preliminary and main damper, wherein the output part of the torsion vibration damper is a hub which holds a flange which has an internal profile and forms the output part of the main damper, with this internal profile engaging with torsional play with an external profile of the hub, furthermore on each side of the flange there is a side disc and these side discs are connected together secured against rotation and form the input part of the main damper, characterised in that an input part, which is rotationally connected to the flange, and an output part, which is rotationally connected to the hub, of the preliminary damper are mounted axially between one of the side discs and the flange, furthermore a friction control disc is provided axially between the other side disc and the other side of the flange, wherein the friction control disc has extension arms which engage with torsional play in recesses of the flange and interact with energy accumulators of the preliminary damper which only become active after a relative rotation between the input part and output part of the preliminary damper from an initial starting position.

2. Torsion vibration damper according to claim 1 characterised in that the energy accumulators of the preliminary damper which interact with the extension arms

of the friction control disc form the second spring stage of the preliminary damper.

3. Torsion vibration damper according to claim 1 characterised in that the torsional play between the extension arms and the recesses of the flange correspond at least to the torsional angle of the second spring stage of the preliminary damper.

4. Torsional vibration damper according to one of claims 1 to 3 characterised in that the energy accumulators of the second preliminary damper stage have a steeper characteristic than the energy accumulators of the first preliminary damper stage.

5. Torsion vibration damper according to one of claims 1 to 4 characterised in that the extension arms of the friction control disc engage with torsional play in the recesses of the preliminary damper output part.

6. Torsion vibration damper according to claim 5 characterised in that the torsional play enables torsion between the preliminary damper output part and the main damper flange which corresponds at least to the torsional angle of the first spring stage of the preliminary damper.

7. Torsion vibration damper according to one of claims 1 to 6 characterised in that the input part of the preliminary damper has recesses for the energy accumulator of the preliminary damper.

8. Torsion vibration damper according to one of claims 1 to 7 characterised in that the input part of the

preliminary damper is connected for rotation with the flange through a push-fit connection.

9. Torsion vibration damper according to one of claims 1 to 8 characterised in that the flange has recesses for at least partially holding the energy accumulators of the preliminary damper.

10. Torsion vibration damper according to one of claims 1 to 9 characterised in that the main damper has an at least two-stage spring characteristic,.

11. Torsion vibration damper according to claim 10 characterised in that the energy accumulators of the second stage of the main damper produce a greater torsional stiffness between the input part and output part of the main damper than the energy accumulators of the first spring stage of the main damper.

12. Torsion vibration damper according to one of claims 1 to 11 characterised in that a friction device having a plate spring is provided between the input part of the preliminary damper rotationally connected to the flange of the main damper, and the adjoining side disc.

13. Torsion vibration damper according to claim 12 characterised in that the plate spring tensions the input part of the preliminary damper axially against the flange.

14. Torsion vibration damper according to claim 12 or 13 characterised in that the friction device produces a basic friction which acts over the entire possible torsional angle of the main damper.

15. Torsion vibration damper according to one of claims 1 to 14 characterised in that the friction control disc is in direct friction engagement with the flange.

16. Torsion vibration damper according to one of claims 1 to 15 characterised in that the friction control disc is tensioned by a plate spring (46) against the flange.

17. Torsion vibration damper according to claim 16 characterised in that the plate spring has a rotationally locked connection with the friction control disc.

18. Torsion vibration damper according to claim 16 or 17 characterised in that the plate spring has radially on the outside extension arms which interact with recesses of the friction control disc to form a rotationally locked connection between these parts.

19. Torsion vibration damper according to one of claims 16 to 18 characterised in that the plate spring is supported radially inside on a friction ring.

20. Torsion vibration damper according to one of claims 16 to 19 characterised in that the plate spring is axially tensioned in that it is directly supported on one side radially outside on the friction control disc and radially inside on a friction ring.

21. Torsion vibration damper according to one of claims 19 and 20 characterised in that the friction ring is supported directly on the adjoining side disc.

22. Torsion vibration damper according to one of claims 1 to 21 characterised in that a centring action produced

through conical faces is provided between one of the side discs and the hub.

23. Torsion vibration damper according to claim 22 characterised in that one of the conical faces is formed by a friction ring.

24. Torsion vibration damper according to one of claims 1 to 23 characterised in that both the preliminary damper and the main damper have a two-stage characteristic.

25. Torsion vibration damper according to one of claims 1 to 24 characterised in that the first friction stage of the preliminary damper comprises a plate spring which on one side is supported axially on one of the side discs and biases the hub axially in the direction of the other side disc.

26. Torsion vibration damper according to claim 25 characterised in that a friction ring is provided between the plate spring and the hub.

27. Torsion vibration damper according to one of claims 25 or 26 characterised in that the plate spring is mounted on the side of the flange of the main damper facing away from the friction control disc.

28. Torsion vibration damper according to at least one of the preceding claims characterised in that the main damper (2) has a friction control disc.

29. Torsion vibration damper according to claim 28 characterised in that the friction control disc has areas

which interact with the energy accumulators of the second spring stage of the main damper.

30. Torsion vibration damper according to at least one of the preceding claims characterised in that the friction control disc of the main damper is supported by one of the side discs.

31. Torsion vibration damper according to claim 30 characterised in that the friction control disc is in direct friction contact with the side disc supporting same.

Amendments to the claims have been filed as follows

CLAIMS

1. Torsion vibration damper with at least one preliminary damper acting over an angular region and having energy accumulators of lesser stiffness, and at least one main damper acting over a further angular region and having energy accumulators of a greater stiffness, wherein the energy accumulators are compressible between the relevant associated input and output parts of the preliminary and main damper, wherein the output part of the torsion vibration damper is a hub which holds a flange which has an internal profile and forms the output part of the main damper, with this internal profile engaging with torsional play with an external profile of the hub, furthermore on each side of the flange there is a side disc and these side discs are connected together secured against rotation and form the input part of the main damper, characterised in that an input part (29), which is rotationally connected to the flange (8), and an output part (22), which is rotationally connected to the hub (11), of the preliminary damper (3) are mounted axially between one of the side discs (4,7) and the flange (8) furthermore a friction control disc (47) is provided axially between the other side disc (7,5) and the other side of the flange (8), wherein the friction control disc (47) has extension arms (50) which engage with torsional play in recesses (51) of the flange (8) and interact with energy accumulators (33) of the preliminary damper (3) which only become active after a relative rotation between the input part and output part of the preliminary damper from an initial starting position.

2. Torsion vibration damper according to claim 1 characterised in that the energy accumulators (33) of the preliminary damper (3) which interact with the extension arms (50)

of the friction control disc (47) form the second spring stage of the preliminary damper (3).

3. Torsion vibration damper according to claim 1 characterised in that the torsional play between the extension arms (50) and the recesses (51) of the flange (8) correspond at least to the torsional angle of the second spring stage of the preliminary damper (3).

4. Torsional vibration damper according to one of claims 1 to 3 characterised in that the energy accumulators of the second preliminary damper stage have a steeper characteristic than the energy accumulators of the first preliminary damper stage.

5. Torsion vibration damper according to one of claims 1 to 4 characterised in that the extension arms of the friction control disc engage with torsional play in the recesses of the preliminary damper output part.

6. Torsion vibration damper according to claim 5 characterised in that the torsional play enables torsion between the preliminary damper output part and the main damper flange which corresponds at least to the torsional angle of the first spring stage of the preliminary damper.

7. Torsion vibration damper according to one of claims 1 to 6 characterised in that the input part of the preliminary damper has recesses for the energy accumulator of the preliminary damper.

8. Torsion vibration damper according to one of claims 1 to 7 characterised in that the input part of the

preliminary damper is connected for rotation with the flange through a push-fit connection.

9. Torsion vibration damper according to one of claims 1 to 8 characterised in that the flange has recesses for at least partially holding the energy accumulators of the preliminary damper.

10. Torsion vibration damper according to one of claims 1 to 9 characterised in that the main damper has a~~n at least~~ two-stage spring characteristic,.

11. Torsion vibration damper according to claim 10 characterised in that the energy accumulators of the second stage of the main damper produce a greater torsional stiffness between the input part and output part of the main damper than the energy accumulators of the first spring stage of the main damper.

12. Torsion vibration damper according to one of claims 1 to 11 characterised in that a friction device having a plate spring is provided between the input part of the preliminary damper rotationally connected to the flange of the main damper, and the adjoining side disc.

13. Torsion vibration damper according to claim 12 characterised in that the plate spring tensions the input part of the preliminary damper axially against the flange.

14. Torsion vibration damper according to claim 12 or 13 characterised in that the friction device produces a basic friction which acts over the entire possible torsional angle of the main damper.

15. Torsion vibration damper according to one of claims 1 to 14 characterised in that the friction control disc is in direct friction engagement with the flange.

16. Torsion vibration damper according to one of claims 1 to 15 characterised in that the friction control disc is tensioned by a plate spring (46) against the flange.

17. Torsion vibration damper according to claim 16 characterised in that the plate spring has a rotationally locked connection with the friction control disc.

18. Torsion vibration damper according to claim 16 or 17 characterised in that the plate spring has radially on the outside extension arms which interact with recesses of the friction control disc to form a rotationally locked connection between these parts.

19. Torsion vibration damper according to one of claims 16 to 18 characterised in that the plate spring is supported radially inside on a friction ring.

20. Torsion vibration damper according to one of claims 16 to 19 characterised in that the plate spring is axially tensioned in that it is directly supported on one side radially outside on the friction control disc and radially inside on a friction ring.

21. Torsion vibration damper according to one of claims 19 and 20 characterised in that the friction ring is supported directly on the adjoining side disc.

22. Torsion vibration damper according to one of claims 1 to 21 characterised in that ~~a centring action produced~~ one of the side discs (4,7) is supported on the hub (11) on a conical surface.

~~through conical faces is provided between one of the side discs and the hub.~~

23. Torsion vibration damper according to claim 22 characterised in that one of the conical faces is formed by a friction ring.

24. Torsion vibration damper according to one of claims 1 to 23 characterised in that both the preliminary damper and the main damper have a two-stage characteristic.

25. Torsion vibration damper according to one of claims 1 to 24 characterised in that the first friction stage of the preliminary damper comprises a plate spring which on one side is supported axially on one of the side discs and biases the hub axially in the direction of the other side disc.

26. Torsion vibration damper according to claim 25 characterised in that a friction ring is provided between the plate spring and the hub.

27. Torsion vibration damper according to one of claims 25 or 26 characterised in that the plate spring is mounted on the side of the flange of the main damper facing away from the friction control disc.

28. Torsion vibration damper according to at least one of the preceding claims characterised in that the main damper (2) has a friction control disc.

29. Torsion vibration damper according to claim 28 characterised in that the friction control disc has areas

Application No: GB 0101184.0
Claims searched: 1-18

Examiner: J. C. Barnes-Paddock
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Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.S): F2U

Int Cl (Ed.7): F16F 15/12, 121, 123, 124, 129

Other: Online: WPI EPODOC PAJ

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
A	GB2258515 A	(FICHTEL & SACHS) See Figure 1. Friction disc on flange opposite side to pre-damper spring.	
A	US5884743	(FICHTEL & SACHS) See Figure 1. Load friction device extension 46 in flange window near pre-damper.	
A	DE19526053 A	(FICHTEL & SACHS) See Figure 1 Spring engaging friction element on opposite side of flange to spring.	

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
		E	Patent document published on or after, but with priority date earlier than, the filing date of this application.
&	Member of the same patent family		